APPENDIX B

Conservation Profiles for Unique Habitats of GCN

CONSERVATION PROFILE:
CENTENNIAL VALLEY SAND DUNES

Photo Credit: Peter Lesica

Photo 1. Centennial Valley Sand Dunes in Beaverhead County, Montana.

PURPOSE:

This conservation profile provides information about the Centennial Valley Sand Dunes, Unique Habitat of Greatest Conservation Need (GCN) in Montana. It highlights the sand dunes' unique physical characteristics; its state distribution; ecological values to rare plants and animals; factors that influence this habitat's vulnerability to persistence; and voluntary conservation objectives, that, if continued or implemented, would aid its persistence in Montana. The conservation profile aims to be a brief, stand-alone document that can be used by or shared with land managers, landowners, educators, decision-makers, regulators, and anyone interested in the Centennial Valley Sand Dunes; it may also apply to other areas of sandy deposits that are not associated with a dune system. This conservation profile should also be used in conjunction with Section 5 of the Montana Native Plant Conservation Strategy which addresses overarching conservation objectives for Unique Habitats of GCN.

INFORMATION ON THE CENTENNIAL VALLEY SAND DUNES

Origins of the Centennial Valley Sand Dunes

The Centennial Valley Sand Dunes[1] comprise approximately 3,000 acres of a unique habitat type that occurs in southwest Montana (Photo 1). They are mostly stabilized habitats of the Barchan sand dune system, crests of dunes that mostly parallel the prevailing winds (Wikipedia[2]).

The dunes are a post-Pleistocene feature that developed over time as the once-extensive Red Rock Lakes (or single lake at the time) receded, leaving lakebed sediments and other Quaternary-period depositional materials exposed to prevailing southwesterly winds. The finer materials were eroded away while the coarse-textured sands settled northeast of the source, building into a Barchan dune system. The relatively high elevation (6,680 to 6,720 feet) and low annual precipitation (averaging 20.4 inches over a 46-year period) in the dune area support the development of an Intermountain shrubland or steppe on silty alluvial soils. The area is dominated by several species of sagebrush (Artemisia), mostly Mountain Big Sagebrush (*Artemisia tridentata* var. v*aseyana*), Basin Big Sagebrush (*A. tridentata* var. *tridentata*), and Three-tip Sagebrush (*A. tripartita*). Dominating the undergrowth are Needle-and-Thread Grass (*Stipa comata*) and Idaho Fescue (*Festuca idahoensis*) along with a forb component that is diverse but low in cover. Non-native plant species are uncommon on the dunes. Blowout areas with little or no vegetation dot the landscape.

Location of Montana's Sand Dunes

The dunes are in the Centennial Valley, in the far southeastern portion of Beaverhead County. They occupy at least 3,100 acres. The North Valley Road traverses through a portion of the sand dunes, which is accessed from the Red Rock Pass Road between Henrys Lake, Idaho and Monida, Montana. Additional sites of sand dune habitat may also exist.

Portions of eastern Montana also have areas of sandy deposits which also create a unique habitat. However, they are not associated with a dune system.

Management of Montana's Sand Dunes

The Centennial Valley Sand Dunes stretch across multiple landownerships and conservation easements that are managed by the following organizations:

- US Fish and Wildlife Service (USFWS) lands, including Red Rocks National Wildlife Refuge (NWR)
- Montana/Dakotas Bureau of Land Management (MT/Dakotas BLM)
- Montana Department of Natural Resources and Conservation (MTDNRC), including Montana State Trust Lands
- The Nature Conservancy (TNC)
- Private landowners

Most of the sand dunes are under some degree of protection. Approximately 800 acres in the easternmost portion of the sand dunes are managed by the USFWS (Red Rocks NWR) and another 2,300 acres on the western end

[1] A 'sand dune' is a mound of sand formed by the wind and dunes grow as grains of sand accumulate (Wikipedia 2024); it is technically the more correct term for this unique habitat. A 'sand hill' is a type of ecological community or xeric-wildfire maintained ecosystem (Wikipedia 2024).

[2] Barchan on Wikipedia: https://en.wikipedia.org/wiki/Barchan

of these holdings are managed by the TNC or MT/Dakotas BLM. A portion is in an easement to the USFWS from TNC. The MT/Dakotas BLM manages the Centennial Sandhills Area of Critical Environment Concern (ACEC), which is approximately six miles north of Lakeview Montana[3]. Approximately 1,040 acres of public lands provide habitat for BLM's special status plant species in the ACEC (USDI-BLM 2006). A small fraction of the dune system is privately held land.

There are good working relationships among TNC, private landowners, MT/Dakotas BLM, MTDNRC, and USFWS, and overall support to ensure the persistence of the Centennial Valley Sand Dunes (Berkey 2023). In addition, the Centennial Valley Association (CVA)[4], a landowner-led nonprofit, facilitates community-based conservation (conducting joint projects, education, and conflict resolution) while preserving traditional ranching in the region (Montana Native Plant Conservation Strategy-Centennial Valley Sand Dunes Work Group 2023; CVA 2024).

Unique Ecology and Biological Distinctions

The sand dunes (with soils classified as Typic Cryopsamments) have lost much of their high dune structure and today typically rise to approximately 15 feet above the surrounding terrain, though some may be taller. The dunes themselves have become predominantly rounded and stabilized by sagebrush steppe vegetation. Nonetheless, the Centennial Valley Sand Dunes are thought to be the highest dunes by elevation in the Northern Rocky Mountains. Sand-dominated blowouts occur throughout the dune landscape and are initiated by a variety of disturbance factors, such as fire, domestic livestock grazing, and rodent activity. These blowouts constitute an early successional stage of having low vegetation cover, which is essential to maintaining several of the dunes' unique biological features.

The sand dunes have become an important habitat that supports many rare plant and animal species and rare plant community types in Montana. The sand dunes remain under-surveyed and may support other unique species and community types that are not currently documented.

Rare Vascular Plant Species

The rarest associated plant is Painted Milkvetch (*Astragalus ceramicus* var. *apus*) (MTNHP 2024a). Nearly as rare is the Sand Wildrye (*Elymus flavescens)*, for which the Centennial Valley is the only known location in the state of Montana (MTNHP 2024b). Fendler Cat's-eye (*Cryptantha fendleri*) is a third rare plant known to rely on the sand dunes (MTNHP 2024c).

Learn about Painted Milkvetch[5], Sand Wildrye[6], and Fendler Cat's-eye[7] plant identification, biology, and status in the Montana Field Guide.

Rare Animal Species

Several rare animals also associate with these sand dunes. The Columbia Plateau Pocket Mouse (*Perognathus parvus*) is a rare mammal found in southeast Montana where it has been captured on the sand dunes (Hendricks and Roedel 2002; MTNHP 2024d). The Big Sand (*Cicindela formosa*) and Saint Anthony Dune (*C. arenicola*) Tiger Beetles live in the sand dune habitat where they are disjunct from

[3] Centennial Valley ACEC map: https://eplanning.blm.gov/public_projects/lup/77497/103609/126896/map8.pdf
[4] Centennial Valley Association: https://www.centennialvalleyassociation.org
[5] Montana Field Guide – Painted Milkvetch: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PDFAB0F1V1
[6] Montana Field Guide – Sand Wildrye: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PMPOA6P080
[7] Montana Field Guide – Fendler Cat's-eye: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PDBOR0A0X0

other known populations (MTNHP 2024e and 2024f). The next closest known population of Big Sand Tiger Beetle is approximately 250 miles to the northeast (Hendricks and Lesica 2007). Saint Anthony Dune Tiger Beetle is globally rare and populations are typically found in dune habitat along the Snake River in central Idaho (Bosworth 2010; NatureServe 2024a; MTNHP 2024f); this beetle is also a Montana Species of Concern (SOC) where its only state population is found in the Centennial Valley (MTNHP 2024f). The Western Bumble Bee (Bombus occidentalis) is a Montana SOC insect that has been captured in proximity to sand dune habitat (MTNHP 2022; MTNHP 2024g). Petitioned in 2015 for listing under the federal Endangered Species Act, the status of the Western Bumble Bee is currently being reviewed by the USFWS (Federal Register 2016; USFWS 2024).

Photo Credit: Peter Lesica

Photo 2. Sandy dunes and other areas of sandy deposits form a unique habitat that boosts biodiversity in Montana.

Learn about Columbia Plateau Pocket Mouse[8], Big Sand Tiger Beetles[9] and Saint Anthony Dune Tiger Beetles[10], and Western Bumble Bee[11] identification, biology, and status in the Montana Field Guide.

Rare or Unique Plant Communities

The Centennial Valley Sand Dunes are also the only Montana location for three plant associations that may be globally unique or State rare:

- Yellow Rabbitbrush / Needle-and-thread Shrubland (*Chrysothamnus viscidiflorus* / *Stipa comata* Shrubland)
- Basin Big Sagebrush / Needle-and-thread Shrubland (*Artemisia tridentata* var. *tridentata* / *Hesperostipa comata* Shrubland, CEGL002966[12]) (NatureServe 2024b)
- Thick-spike Wheatgrass / Silverleaf Phacelia Grassland (*Elymus lanceolatus* - *Phacelia hastata* Grassland, CEGL001745[13]) (NatureServe 2024c)

Learn about the distribution, ecology, classification, and status of these plant associations in NatureServe Explorer.[12,13]

[8] Montana Field Guide – Columbia Plateau Pocket Mouse: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=AMAFD01100

[9] Montana Field Guide – Big Sand Tiger Beetle: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=IICOL02040

[10] Montana Field Guide – St. Anthony Dune Tiger Beetle: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=IICOL02130

[11] Montana Field Guide – Western Bumble Bee: https://fieldguide.mt.gov/speciesDetail.aspx?elcode=IIHYM24252

[12] NatureServe Explorer – CEGL002966: https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.689792/Artemisia_tridentata_ssp_tridentata_-_Hesperostipa_comata_Shrubland

[13] NatureServe Explorer - CEGL001745: https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.684114/Elymus_lanceolatus_-_Phacelia_hastata_Grassland

RATIONALE FOR UNIQUE HABITAT OF GREATEST CONSERVATION NEED

The Centennial Valley Sand Dunes are a Unique Habitat of Greatest Conservation Need (GCN) because they occur in a small portion of Montana, provide habitat for numerous unique and declining species and plant associations, and require particular disturbance regimes to persist. Their limited distribution in southwest Montana makes them an iconic part of Beaverhead County. The unique physical characteristics that create and maintain this habitat have influenced many plant and animal species, contributing significantly to biodiversity found in Montana. Yet in our changing world, the suite of interacting environmental processes that create and maintain the sand dunes are shifting, which threatens their persistence and the rare plants, animals, and plant associations that reside in them.

Natural plant succession is the most significant threat to this unique habitat and the rare species that inhabit them. The rare plants rely on disturbed sites (i.e., "blowout" areas with low plant cover) to establish and flourish. Historically, blowouts were generated by strong winds following reductions in vegetation cover initiated by fire, intensive ungulate grazing, and pocket gophers (*Thomomys talpoides*; Lesica and Cooper 1999). With settlement of the Centennial Valley, the agents that cause blowouts are no longer sufficient to create an abundance of large, open sand environments. The subsequent stabilization of the dunes by vegetation has reduced the open sand habitat that the rare plant and animal species need. Approaches to creating more blowouts, or at least the early successional stages required to maintain the rare species, have been outlined by Lesica and Cooper (1999) and Schassberger (1988). These include increasing the grazing pressure across the dunes, with the aim of reducing the cover of the grazing-sensitive *Festuca idahoensis* to create blowout areas.

The increase in invasive and noxious weeds in Montana poses another strong, but potential threat to the Centennial Valley Sand Dunes. Of the 50 noxious, regulated, and invasive aquatic plant species in Montana, Cheatgrass (*Bromus tectorum*) is the primary threat to the sand dunes habitat (Bosworth 2010). Cheatgrass is known to grow well in arid environments, colonize disturbed habitats, rapidly sequester moisture, and prolifically sprout from seed (Mosely et al. *in* Sheley and Petroff 1999). Where populations grow, it remains persistent and changes the fire regime and ecological processes in the area (Pellant 1990; Peters and Bunting 1994). Since at least the early 2000s, ongoing cooperative efforts between CVA members and government management agencies have prevented and controlled invasive and noxious plants, resulting in a landscape that is little impacted by weeds (Centennial Valley Sand Dune Working Group 2023). However, monitoring for and controlling of non-native plants is an on-going, continual task.

CONSERVATION GOALS & OBJECTIVES

The goal is to sustain the Centennial Valley Sand Dunes Unique Habitat of GCN, and the Plant Species of GCN, rare animal species, and rare plant associations that rely on them. Effectively conserving the Centennial Valley Sand Dunes requires a fusion of biological, academic, management, educational, and possibly economic and political approaches. Sustaining the Centennial Valley Sand Dunes Unique Habitat of GCN in Montana encompasses objectives from four areas that are pillars for plant and habitat conservation:

- Information Needs [Inventory, Monitoring, Research]
- Protection and Restoration
- Outreach and Education
- Policy and Regulation

Photo Credit: Matt Lavin

Photo 3. Sand Wildrye (Elymus flavescens)*, a Plant Species of GCN, occurs in the Centennial Valley Sand Dunes Unique Habitat of GCN.*

Implementing any of the following conservation objectives should enhance the integrity, function, and/or longevity of the Centennial Valley Sand Dunes unique habitat and the rare plant and animal species and plant associations that rely on them. These conservation objectives were developed by members of the Strategy's Core Team with major input from land managers in the Centennial Valley representing TNC, USFWS, and MT/Dakotas BLM. They should also be used in conjunction with overarching conservation objectives that apply generally to Unique Habitats of GCN (refer to Section 5 of this *Strategy*). Working within and across jurisdictional boundaries, these conservation objectives are voluntary measures intended to empower land managers, landowners, non-governmental organization leaders, and individuals who want to work together to sustain Centennial Valley Sand Dunes across the Montana landscape.

Information Needs [Inventory, Monitoring, Research]

Conservation Goal

Improve scientific understanding of the ecological processes that form the Centennial Valley Sand Dunes and the natural history and status of associated rare plant and animals through inventory, monitoring, and research.

Conservation Objectives or Actions

1) Conduct field surveys, monitoring, and research that operate across jurisdictions and elicits information to assist in the management and/or ecological understanding of sand dune habitat and species. Identified topics include, but are not limited to:
   a. Distributional extent of dune stabilization and the locations and sizes of blowout areas.
   b. Examination of the ecological responses of plant and animal species in the sand dune system from the extensive sagebrush die-off that began in Spring 2018.
   c. Assess population counts and conduct mapping for each plant and animal species identified in this profile.
   d. Conduct field surveys, population estimates, and mapping of non-native invasive, noxious, and regulated plant species, especially in areas where weeds were previously treated or controlled.
   e. Examine the effects of grazing relative to sand dune creation and stabilization. Studies should quantify baseline conditions, test experimental methods, and quantify changes.
2) Conduct research that studies historic management practices (livestock grazing, fire management, pre-settlement vegetation (Lesica and Cooper 1997), and others) and treatments to assess their impacts on plant composition and the potential to create/retain sand dune habitat for rare species.
3) Compile past and existing monitoring and inventory protocols and generated data to analyze or summarize information relative to sand dune habitat and species management. Sources of past data collection efforts include, but are not limited to:
   a. Idaho Natural Heritage Program for tiger beetle studies and protocols (see also Bosworth et al. 2010).
   b. Monitoring data collected in 2011 by TNC and MT/Dakotas BLM.
   c. USFWS archives, including at Red Rocks NWR, for past survey and monitoring results.
   d. Data from the "Creative management strategies" conducted by USFWS and MT/Dakotas BLM, e.g., the 2017 Salt Block Pilot Study, which placed salt blocks in specific locations to attract ungulates to create ground disturbance. Data collected included surveys for rare plants and percent cover of bare ground.
   e. Past seed collection projects that may have included descriptions of vegetation.

Information Needs [Inventory, Monitoring, Research]

4) Develop a high-resolution map of the dune landscape and its plant associations, including documenting locations of rare plant and animal species and plant associations. The map could identify areas that have high potential for habitat restoration, which are places with the barest ground. The map could identify sites for implementing a high-intensity grazing system. The map could also identify the best spots for rare plant and animal species recruitment.

5) Collaborate with the MTDNRC who has a program for using drones. Drones may be useful for collecting low-elevation imagery, and re-collecting imagery at intervals to show changes in habitat.

6) Promote research to determine the historic frequency and distribution of blowout areas, with the goal of increasing the recruitment of open dune-dependent rare plant species. One such project could be to promote high-intensity, short-term grazing to mimic historic bison use of the area.

7) Expand into the dune landscape a 2022/2023 TNC study of bird responses to grazing treatments that is taking place in the adjacent shrub-steppe communities.

8) Consult the Biological Inventory of the Great Sand Dunes and San Luis Lakes publication (Pineda et al. 1999) to determine if any recommendations or information is useful for management of the Centennial Valley Sand Dunes Unique Habitat of GCN.

Protection and Restoration

Conservation Goal

Secure on-the-ground, site-specific habitat and/or management protection or restoration for the Centennial Valley Sand Dunes that also sustains populations of rare plant species, animal species, and plant associations.

Conservation Objectives or Actions

1) Convene a "local management team" with representation from the CVA, TNC, USFWS, MT/Dakotas BLM, and MTDNRC to continue coordination and develop a shared management plan that examines the ecological condition of this unique habitat. The team could also identify potential actions to sustain natural structure, composition, and function, and target areas to enhance or create blowouts and where grazing intensity could be higher.

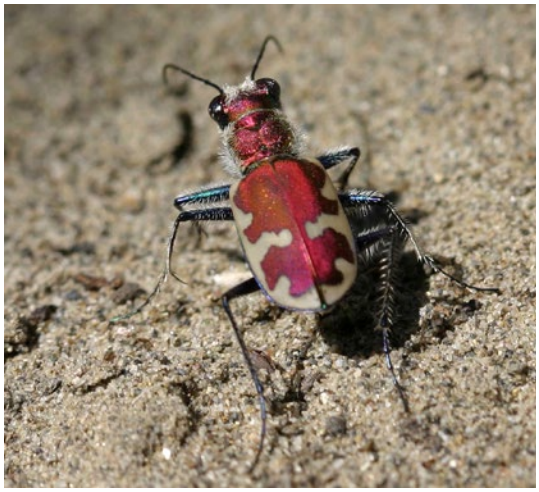

Photo Credit: Chuck Carlson

*Photo 4. Big Sand Tiger Beetle (*Cicindela formosa *ssp.* formosa*) near Fort Peck, Montana.*

2) Consult with the Nebraska Natural Heritage Program[14] on their projects to create blowouts and restore habitat for Blowout Penstemon (*Penstemon haydenii)*, a rare plant in Nebraska and Wyoming.

3) Review the present protection status of land parcels where rare plant and animal species occur - that have a high probability of establishing in the sand dune landscape. Develop management plants aimed to protect and/or restore these areas and to promote persistence of the species.

4) Review MT/Dakotas BLM management of national recreational trails that cross the dune landscape and assess any negative impacts to rare plant and animal species. Where negative impacts are identified, develop and implement a plan to reduce them.

5) Through coordinated efforts, test and develop studies that use livestock as disturbance vectors to create or restore blowouts (see also Information Needs Conservation Objectives 1-6).

6) Convene a meeting or working group led by Montana Native Plant Society (MNPS) members and invite various stakeholders (CVA, TNC, USFWS, MT/Dakotas BLM, and MTDNRC) to discuss the 2011 Centennial Sandhills Important Plant Area (IPA) nomination[15] and possible collaboration to create an officially recognized IPA. The goal of the Montana Native Plant Society's IPA Program[16] is to identify the most important sites for plant conservation across Montana using consistent criteria (MNPS 2023). Important sites exhibit exceptional populations of one or more globally rare plants or uncommon or threatened plant assemblages in Montana (MNPS 2023). An IPA is an informal recognition by MNPS.

Photo Credit: Peter Lesica

*Photo 5. Painted Milkvetch (*Astrataglus ceramicus *var.* apus*) in the Centennial Valley Sand Dunes Unique Habitat, Montana.*

[14] Nebraska Natural Heritage Program [Botanist Gerry Steinauer]: https://outdoornebraska.gov/conservation/conservation-efforts/natural-heritage-program/

[15] MNPS Centennial Sandhills IPA nomination: https://mtnativeplants.org/wp-content/uploads/2018/07/IPA-Centennial-Sand-Hills.pdf

[16] MNPS Important Plants Areas Program: https://mtnativeplants.org/important-plant-areas/

Outreach and Education

Conservation Goal

Facilitate the stewardship of the Centennial Valley Sand Dunes and associate rare plant and animal species and plant associations through education, outreach, and coordination.

Conservation Objectives

1) Continue the good working relationships established among the CVA, TNC, USFWS, MT/ Dakotas BLM, and MTDNRC to facilitate stewardship of the Centennial Valley Sand Dunes and the rare plant and animal species and plant associations found there.

2) Revise profiles on the Montana Field Guide1 for each Plant Species of GCN and other native plant species that associate with the Centennial Valley Sand Dunes Unique Habitat of GCN. Using the newest MTNHP standards will update and expand known information on the species' life history, ecology, wildlife-plant interactions, identification, taxonomy, range, habitat, biology, economics, management, threats, taxonomy, and other interesting facts; improve readability; and link to other online resources. Cross-walking plants, animals, and habitats on the Montana Field Guide will elevate awareness of this unique habitat.

3) Revise profiles on the Montana Field Guide[1] for each animal Species of Concern. Cross-walking plants, animals, and habitats on the Montana Field Guide will elevate awareness of this unique habitat.

4) Consult with educational staff at Montana Fish, Wildlife, and Parks to develop an educational unit about this unique habitat and its associated plants and animals.

5) Through TNC and the Centennial Valley Association, engage private landowner(s) in caring for natural dune habitats, and encourage their participation in the conservation planning effort. Note: The Montana Native Plant Society, through their Small Grants Program, previously funded a CVA weed management project in the Valley; they may be helpful in encouraging landowners to participate in future stewardship activities.

Photo Credit: Matt Lavin

Photo 6. Fendler Cat's-eye (Cryptantha fendleri) in Idaho

Outreach and Education

6) Work with CVA to assess the two kiosks at each end of the Valley to determine their condition and need for updated information. Public educational materials can give recreational users a sense of place, enhance their experience, and garner support for stewardship activities.

   a. Consider adding displays or brochures to the kiosks that inform visitors about this unique habitat and geology, its associated rare plant and animal species, plant associations, and stewardship activities.

   b. Evaluate the kiosks and develop recommendations on how to maintain or repair the kiosks for the short- and long-terms.

7) Work with the USFWS Red Rocks NWR staff to assess the roadside geologic interpretive kiosk to determine its condition and need to update information, including information about the biological uniqueness of the dunes and their importance to rare species conservation. Public educational materials can give recreational users a sense of place, enhance their experience, and garner support for stewardship activities.

   a. Consider adding displays or brochures to the kiosk to inform visitors about this unique habitat and geology, its associated rare plant and animal species and plant associations, and stewardship activities.

   b. Evaluate the kiosks and develop recommendations on how to maintain or repair the kiosks for the short- and long-terms.

8) Open a dialogue with Native American Tribes that undertake "usual and accustomed" activities in the dune landscape to inquire about involvement, and if appropriate to understand how best to steward these areas educate the public about their cultural significance.

Policy and Regulation

Conservation Goal

In cooperation with public land managers, private landowners, and other interested stakeholders, support policies and regulations that aim to conserve the Centennial Valley Sand Dunes and its associated species and plant associations.

Conservation Objectives

1) Through collaboration with CVA, TNC, USFWS, MT/Dakotas BLM, MTDNRC, Montana Native Plant Society (MNPS), and/or other interested landowners, identify and nominate (a) parcel(s) of Centennial Valley Sand Dune habitat to the board of land commissioners [MCA 79-12-104(1)] for possible designation as a Montana Natural Area.

2) For federal and state staff, review federal (USFWS, BLM) and state (DNRC) agencies' policies and land management plans - with TNC to determine whether special protection measures could be applicable, are being implemented, and/or need amending for the Centennial Valley Sand Dunes landscape.

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CONSERVATION PROFILE: METAMORPHOSED LIMESTONE

Photo Credit: Steve Shelly, MTNHP

Photo 1. A metamorphosed limestone outcrop in the Birch Creek drainage of the Pioneer Mountains in Montana.

PURPOSE:

This conservation profile provides information about the Metamorphosed Limestone Unique Habitat of Greatest Conservation Need (GCN) in Montana. It highlights their formation; state distribution; ecological values to rare plants; factors that influence this habitat's vulnerability to persistence; and voluntary conservation objectives, that, if continued or implemented, would aid its persistence in Montana. The conservation profile aims to be a brief, stand-alone document that can be used by or shared with land managers, landowners, educators, decision-makers, regulators, and anyone interested in this unique habitat. This conservation profile should also be used in conjunction with Section 5 of the Montana Native Plant Conservation Strategy which addresses overarching conservation objectives for Unique Habitats of GCN.

INFORMATION ON METAMORPHOSED LIMESTONE UNIQUE HABITAT

Description and Formation

On the margins of some mountain ranges in southwest Montana there are outcroppings of calcareous soils that developed from layers of limestone that were metamorphosed (heated) when the adjacent mountains intruded through those overlying layers (Lesica and Shelly 1992) (Photo 1). The associated substrates are typically light in color and have a thin soil that covers the bedrock or has a gravelly loam surface. In many cases the sites are very sparsely vegetated because they have harsh ecological conditions. The areal extent of these outcrops range from few to several hundred acres. The outcrops are typically visible from adjacent roads or trails due to their distinctive coloration and sparse vegetative cover.

Locations in Montana

Metamorphosed limestone habitat is found in the Sapphire, Pioneer, and Highland Mountains in southwest Montana. In the Sapphire Mountains of Ravalli County, the outcrops occur on the lower western slopes. In Beaverhead County, the outcrops occur in drainages (such as in Birch Creek, Cattle Gulch, and Canyon Creek) on the east and north margins on the eastern side of the Pioneer Mountains. In the Highland Mountains of Silver Bow County, the outcrops occur in the drainages (such as Moose Creek) that are east of Divide, Montana.

Unique Ecology and Biological Distinctions

The Metamorphosed Limestone Unique Habitat has unusual soil conditions. The soils are predominantly calcareous sandy loams, or silty loams, derived from outcrops of metamorphosed calc-silicates or limestone (Lesica 1992; Lesica and Shelly 1994). These soils have a tendency to slump on moderate to steep slopes (Lesica and Shelly 1994). The conditions and properties of these soils have influenced the flora on the landscape (edaphic). As a result, the Metamorphosed Limestone Unique Habitat is distinct from adjacent habitats in a given area.

Areas of Metamorphosed Limestone have become important habitats for specific native plant species and plant communities. Sapphire Rockcress (*Boechera fecunda*) is known only to occur in Montana (State endemic) where its distribution is restricted to the metamorphosed limestone habitats (MTNHP 2024a) (Photo 2; refer to conservation profile in Appendix A). An uncommon plant community found on this substrate is Mountain Mahogany / Bluebunch Wheatgrass (*Cercocarpus ledifolius / Elymus (Agropyron) spicatum*). An outstanding example of this plant community occurs in the Cattle Gulch Research Natural Area (RNA) on the Beaverhead-Deerlodge National Forest.

Photo Credit: Peter Lesica.

*Photo 2. Sapphire Rockcress (*Boechera fecunda*), a Plant Species of GCN, only grows in the Metamorphosed Limestone Unique Habitat.*

Learn about Sapphire Rockcress plant identification, biology, and status in the Montana Field Guide.[1]

[1] Montana Field Guide (MTNHP 2024a): https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PDBRA06290

RATIONALE FOR UNIQUE HABITAT OF GREATEST CONSERVATION NEED

Areas occupied by metamorphosed limestone are designated as a Unique Habitat of Greatest Conservation Need (GCN) in Montana because they formed from unusual conditions, occur across small areas, support rare flora, and face threats that put their persistence into question. On a global scale, Sapphire Rockcress is only found in Montana, and specifically only on metamorphosed limestone habitats. Sapphire Rockcress exemplifies one of Montana's best examples for an edaphic, endemic plant species. The Mountain Mahogany / Bluebunch Wheatgrass is also an uncommon plant community for Montana.

These areas of metamorphosed limestone are facing anthropogenic threats that make the habitat vulnerable to extirpation in Montana. The most imminent threat to these outcrop habitats is invasion from non-native plants, especially in localized places where there is deeper soil development. The outcrops in Ravalli County, which have loamier soils, have the worst infestations of Spotted Knapweed (*Centaurea stoebe)* (Lesica and Shelly 1996). In Beaverhead County, Spotted Knapweed and other non-native plant species are colonizing the lower slopes and access route into the Cattle Gulch RNA. Spotted Knapweed can out-compete native plant species (MTNHP 2024b) while the non-native Cheatgrass (*Bromus tectorum*) has the ability to change a site's ecology (MTNHP 2024c). Other threats identified as occurring in areas of metamorphosed limestone include recreation and incompatible livestock grazing. Recreation and incompatible livestock grazing have been regarded as minor threats.

Photo Credit: Scott Mincemoyer

*Photo 3. Mountain Mahogany (*Cercocarpus ledifolius*) is often dominant in the Metamorphosed Limestone Unique Habitat. Dillon Field Office, MT/Dakotas BLM.*

CONSERVATION GOALS & OBJECTIVES

The goal is to sustain the Metamorphosed Limestone Unique Habitat of GCN and the Plant Species of GCN and uncommon plant communities that rely on them. Effectively conserving the Metamorphosed Limestone unique habitat requires a fusion of biological, academic, management, educational, and possibly economic and political approaches. Sustaining the Metamorphosed Limestone Unique Habitat of GCN in Montana encompasses objectives from four areas that are pillars for plant and habitat conservation:

- Information Needs [Inventory, Monitoring, Research]
- Protection and Restoration
- Outreach and Education
- Policy and Regulation

Photo Credit: Andrea Pipp

Photo 4. The outcrops of the Metamorphosed Limestone Unique Habitat are noticeable on the landscape from afar. Beaverhead-Deerlodge National Forest.

Implementing any of the following conservation objectives should enhance the integrity, function, and/or longevity of the Metamorphosed Limestone unique habitat and the rare plant and communities that rely on them. These conservation objectives were developed by a working group with major input from botanists, an ecologist, and a rangeland management specialist working for the US Forest Service-Region 1, Beaverhead-Deerlodge National Forest (BDNF), Montana/Dakotas Bureau of Land Management (MT/Dakotas BLM), and MT/Dakotas BLM Dillon Field Office. The conservation objectives should also be used in conjunction with overarching objectives that apply generally to Unique Habitats of GCN (refer to Section 5 of this *Strategy*). Working within and across jurisdictional boundaries, these conservation objectives are voluntary and intended to empower land managers, landowners, non-governmental organization leaders, and individuals who want to work together to sustain the Metamorphosed Limestone unique habitat in Montana.

Information Needs [Inventory, Monitoring, Research]

Conservation Goal

Improve scientific understanding of metamorphosed limestone outcrops in southwestern Montana and the natural history and status of associated rare plants and communities through inventory, monitoring, and research.

Conservation Objectives

1) Develop a state-wide data layer for Metamorphosed Limestone Unique Habitat sites. This would involve field data collection efforts, using ESRI Arc-GIS software, Montana State Library (MSL) state data layers, and other tools. Components include, but are not limited to:
   a. Compiling digitized data, reports, and mapping from the MSL-MTNHP and BDNF archives.
   b. Delineate ecological- and geological-based boundaries for each site.
   c. Conduct field visits to verify habitat (ecological and geological signatures) and targeted plant species and plant associations.
2) After developing a state-wide data layer for Metamorphosed Limestone Unique Habitat sites, determine if a predictive habitat model could be developed. Determine the parameters and attributes. Ground-truth sites that are identified as potential habitat. For example, the Cold Springs/Grasshopper Creek area in Beaverhead County may have additional locations.
3) After developing a state-wide data layer for Metamorphosed Limestone Unique Habitat sites, overlay the unique habitat layer with the MTNHP rare plant, rare animal, Ecological Systems, and National Vegetation Classification Systems (NCVS) data layers to determine if other components of rarity overlap.
4) Conduct inventories for additional locations of metamorphosed limestone habitat. For example, the Cold Springs/Grasshopper Creek area in Beaverhead County may have additional locations.
5) For established plots on the Beaverhead-Deerlodge National Forest, continue to collect trend and demographic monitoring data for *Boechera fecunda* populations, analyze data, and report findings (see Section 4 and Sapphire Rockcress Conservation Strategy, Appendix A).
6) Develop a monitoring protocol to track the ecological health and condition of Metamorphosed Limestone Unique Habitat sites across its state range. Threats from invasive weeds, recreational use and livestock grazing should be evaluated.
7) Where 'advanced succession'[2] is occurring in the habitat, develop a management goal, study or monitoring plan, and analysis plan to evaluate and address conifers.
8) Conduct an assessment where any subsequent conifer reduction projects have taken place within or adjacent to Metamorphosed Limestone Unique Habitat sites. Examples: Removing Douglas-fir trees through manual control in Cattle Gulch RNA and Birch Creek.

[2] In the absence of disturbance, vegetation succession naturally occurs. A more accurate ecological term to use is 'advancing succession', which removes any judgements that may come with the use of 'conifer encroachment'.

Protection and Restoration

Conservation Goal

Secure on-the-ground, site specific habitat, and/or management protection or restoration for Metamorphosed Limestone Unique Habitat areas that also sustain populations of associated rare plant species and communities.

Conservation Objectives

1) Assess the suitability of known sites for possible designation as a Research Natural Area (RNA), Botanical Special Area, Area of Critical Environmental Concern (ACEC), MNPS Important Plant Area (IPA), or other conservation target.
2) Determine if any Metamorphosed Limestone Unique Habitat sites are currently included in any conservation easements.
3) Open a dialogue with various land trusts to evaluate if any Metamorphosed Limestone Unique Habitat sites could be included in conservation easements.
4) Where advanced succession is determined to be a threat to Metamorphosed Limestone Unique Habitat sites, develop a management plan and tactics to remove conifers.
5) Where sites are being invaded or encroached upon by invasive non-native plants, implement an integrated weed management plan. As appropriate, work in coordination with county weed districts and private landowners.

Outreach and Education

Conservation Goal

Facilitate the stewardship of metamorphosed limestone habitats and associated rare plant species and communities through education, outreach, and coordination.

Conservation Objectives

1) On the MTNHP Montana Field Guide for Sapphire Rockcress, revise the habitat and/or range sections to address the Metamorphosed Limestone Unique Habitat of GCN.
2) Consult with educational staff at Montana Fish, Wildlife and Parks or Montana Native Plant Society to develop an educational unit on the Metamorphosed Limestone Unique Habitat. Develop outreach materials in coordination with the Montana Native Plant Society.
3) Consider using Citizen Botanists from the MNPS-MTNHP Citizen Botany Program to assist in field inventories and monitoring.
4) Find opportunities to broaden education and awareness of the Metamorphosed Limestone Unique Habitat of GCN within the land management agencies and with the public.

Outreach and Education

5) Evaluate the interpretive sign at Vipond Park[3] to determine its condition and need to update or expand information. If warranted, develop recommendations on how to repair and/or maintain the sign for the short- and long-term.

Policy and Regulation

Conservation Goal

In cooperation with public land managers, private landowners, and other interested stakeholders, support policies and regulations that aim to conserve metamorphosed limestone habitat and associated plant species and plant associations.

Conservation Objectives

1) Both the BDNF and the MT/Dakotas BLM Dillon Field Office have land management plans containing policies that protect rare plants and their habitats. These plans should be consulted for specific conservation measures that pertain to metamorphosed limestone and other habitats of conservation concern:

   a) Beaverhead-Deerlodge NF – Forest Plan[4]: The pertinent sections in this plan include direction for sensitive plant and unique habitat conservation in the Vegetation section of Chapter 3.

   b) BLM Dillon Resource Area – Plan[5]: The pertinent sections in this plan include Special Status Plants; Noxious Weeds, Invasive and Non-Native Species; and Travel Management and OHV Use.

2) Finalize the establishment of the Cattle Gulch RNA on the Beaverhead-Deerlodge NF.

3) Work with state agencies to identify potential conservation opportunities under the Montana Natural Areas Act of 1974.

[3] Vipond Park: https://www.fs.usda.gov/wildflowers/regions/northern/VipondPark/index.shtml

[4] USFS, Beaverhead Deerlodge NF: Beaverhead-Deerlodge National Forest - Planning (usda.gov)

[5] BLM Dillon Field Office: https://eplanning.blm.gov/public_projects/lup/77497/103609/126835/ApprovedPlan.pdf

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